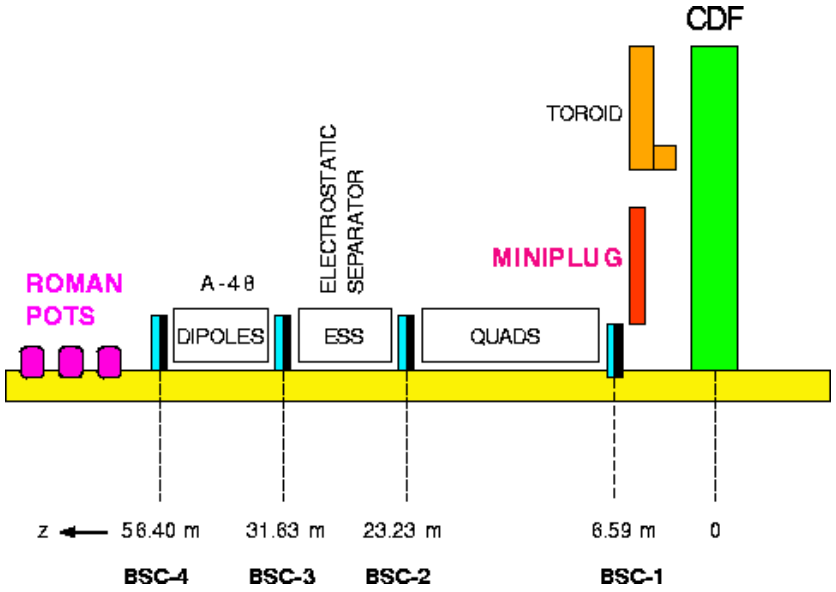
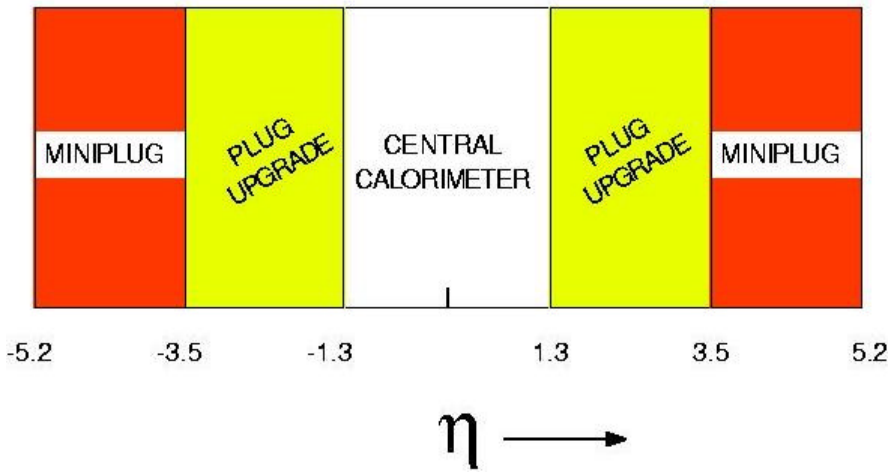
Blessing of

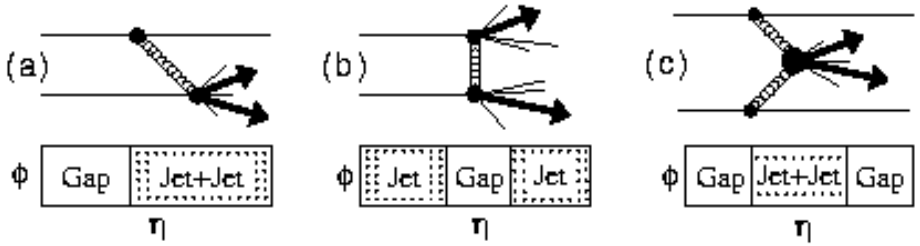
Run II Diffractive Results

- ✓ Introduction
- ✓ Data Selection
- ✓ Plots for Blessing

Forward Physics

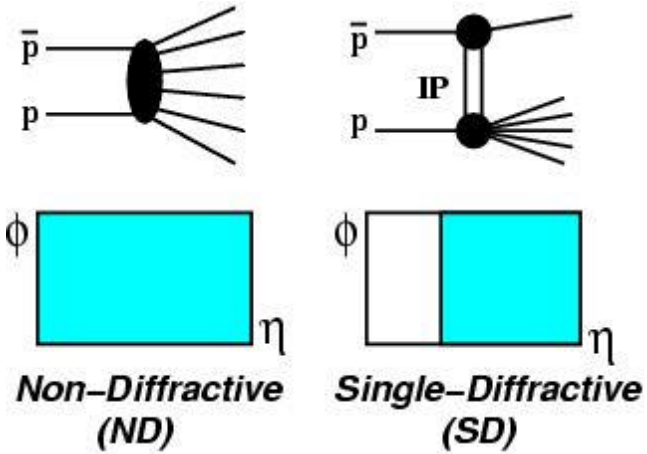






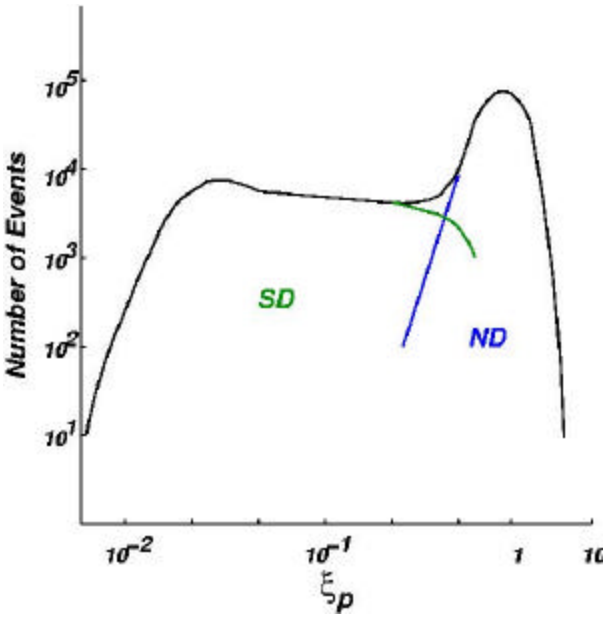
- Hard Single Diffraction
- Double Pomeron Exchange
- …

Diffractive Dijets



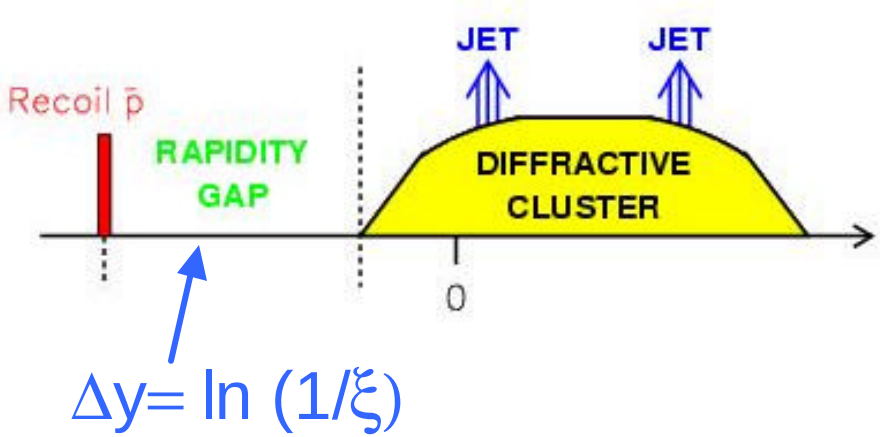
- Compare diffractive events to ND
- Measure diffractive structure function from $R_{SD/ND}$ vs x_{bj}

Measure ξ (pbar momentum loss fraction) from calorimeter information



x : Momentum Loss Fraction

Measure fractional momentum loss of anti-proton



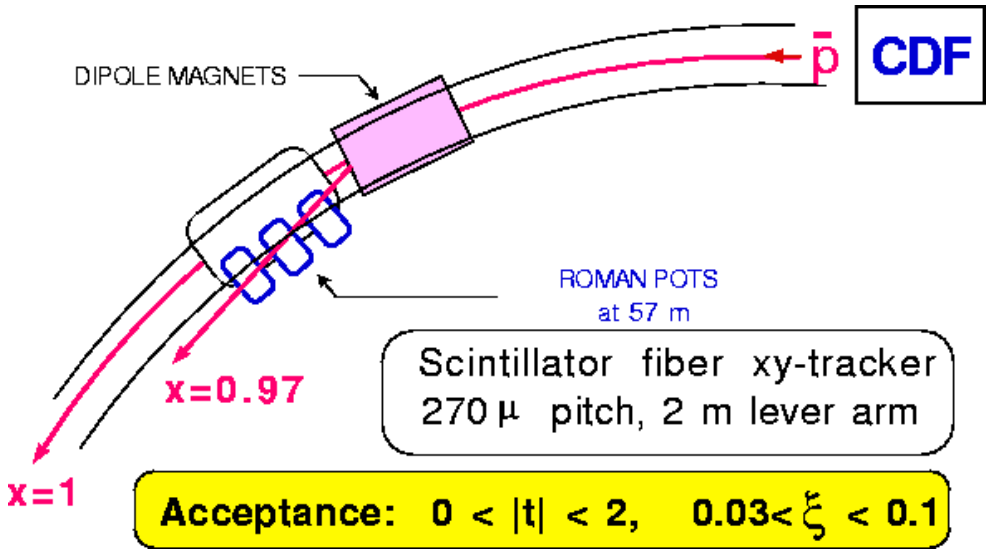
$$x = \frac{M_X^2}{s}$$

$$\Rightarrow x = \frac{\sum E_T e^{-h}}{\sqrt{s}}$$

Diffractive events are boosted towards positive h

⇨ small x

Trigger



require jets

- RP is triggered on leading antiprotons
- Use RP + jet triggers

Data Sample

- **Use dedicated diffractive triggers**
  - **RP+J5 (diffractive sample)**
  - **J5 (control sample)**
- **Data sample ~9 pb^{-1} (PHYSICS_1_03_v1)**

Event Selection

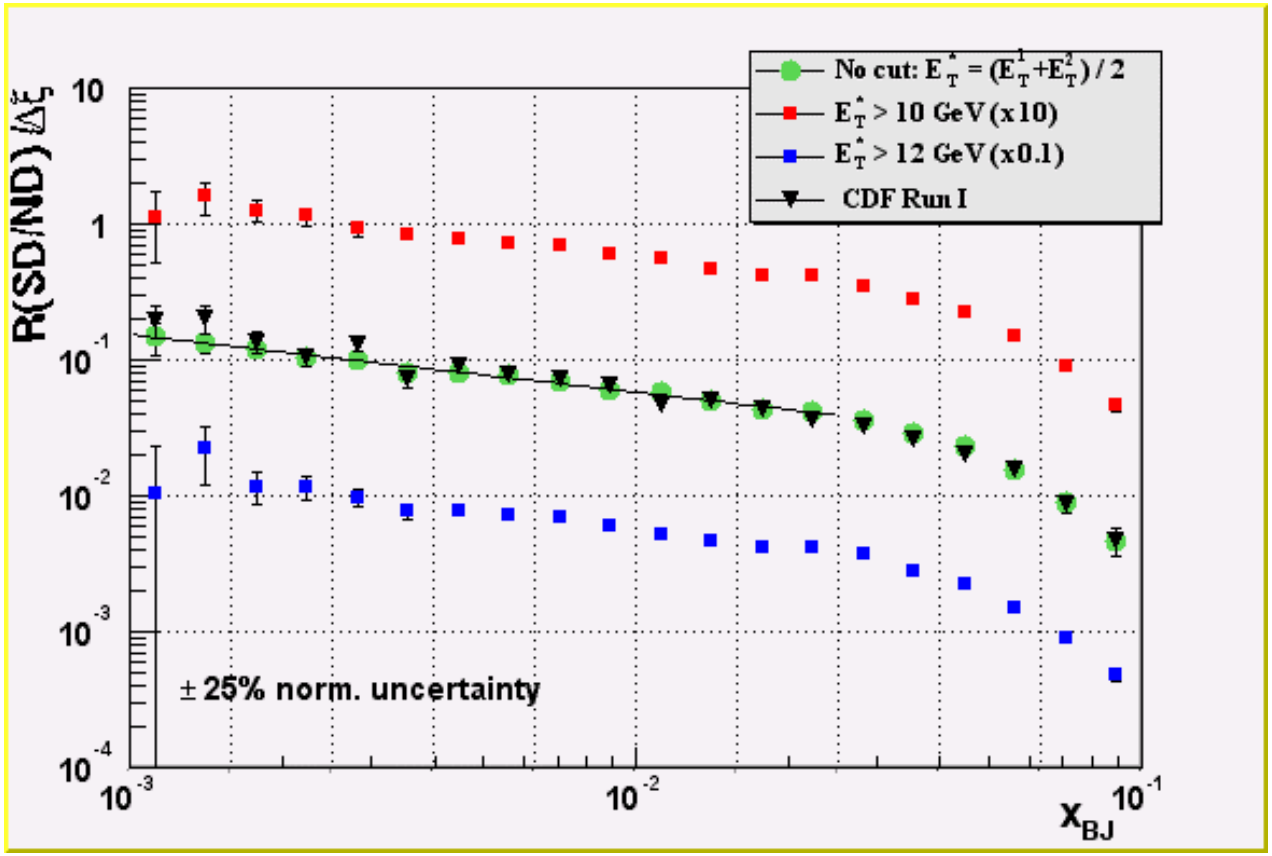
1.	Triggered events	352,359
2.	MET Significance<6	352,359
3.	Two jets (E_T>5, $\|\eta\|$<2.5)	175,292
4.	RP coincidence	168,153
5.	SD (0.02< ξ<0.1)	15,209
6.	All BSC East Gap	1,126

Question #4

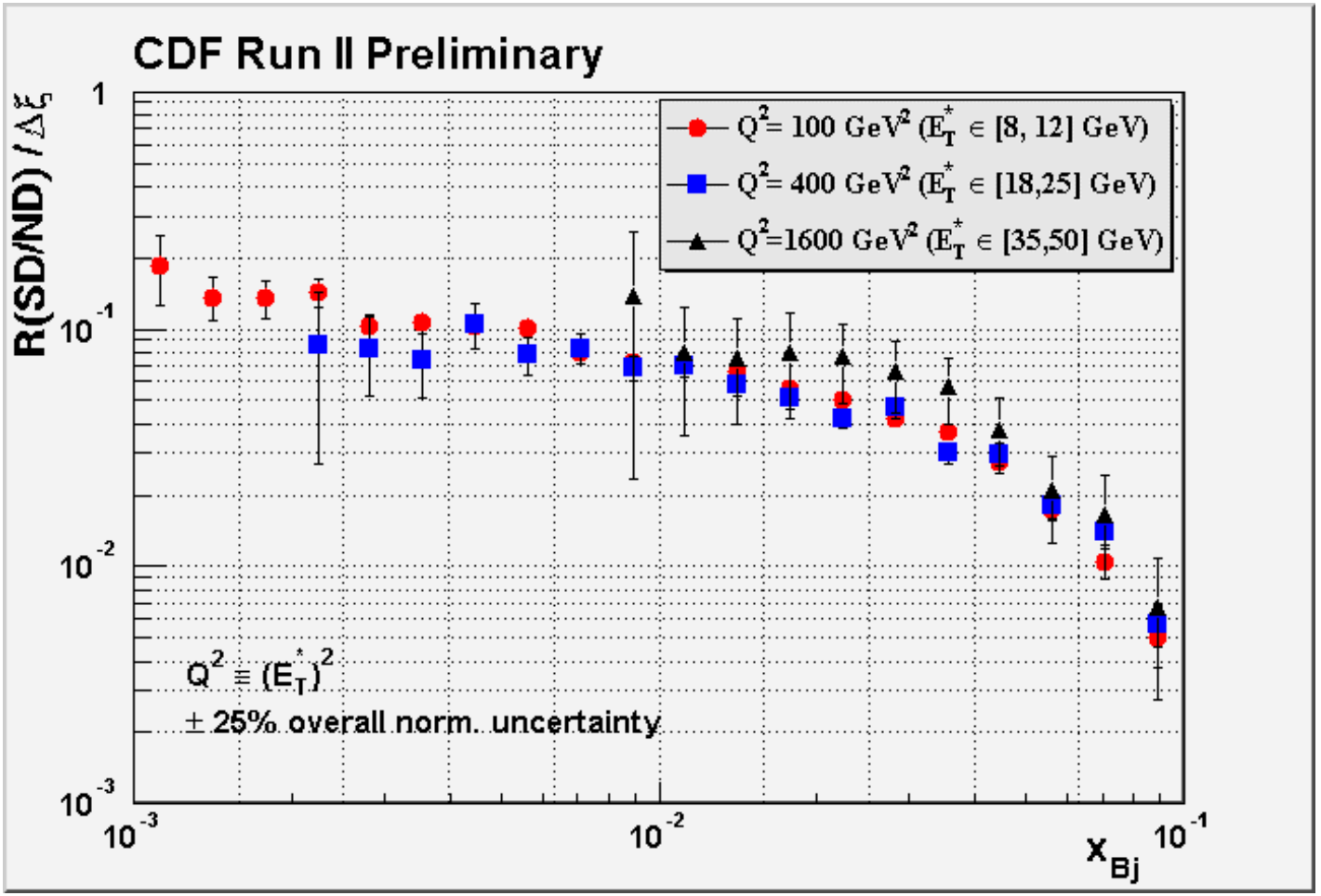
Q : What is the ratio SD/ND for E_T > 10 GeV ?

DSF with Jet E_T cut

$$E_T^* = \frac{E_T^1 + E_T^2}{2}$$



Q^2 Dependence



Answer to Q#4

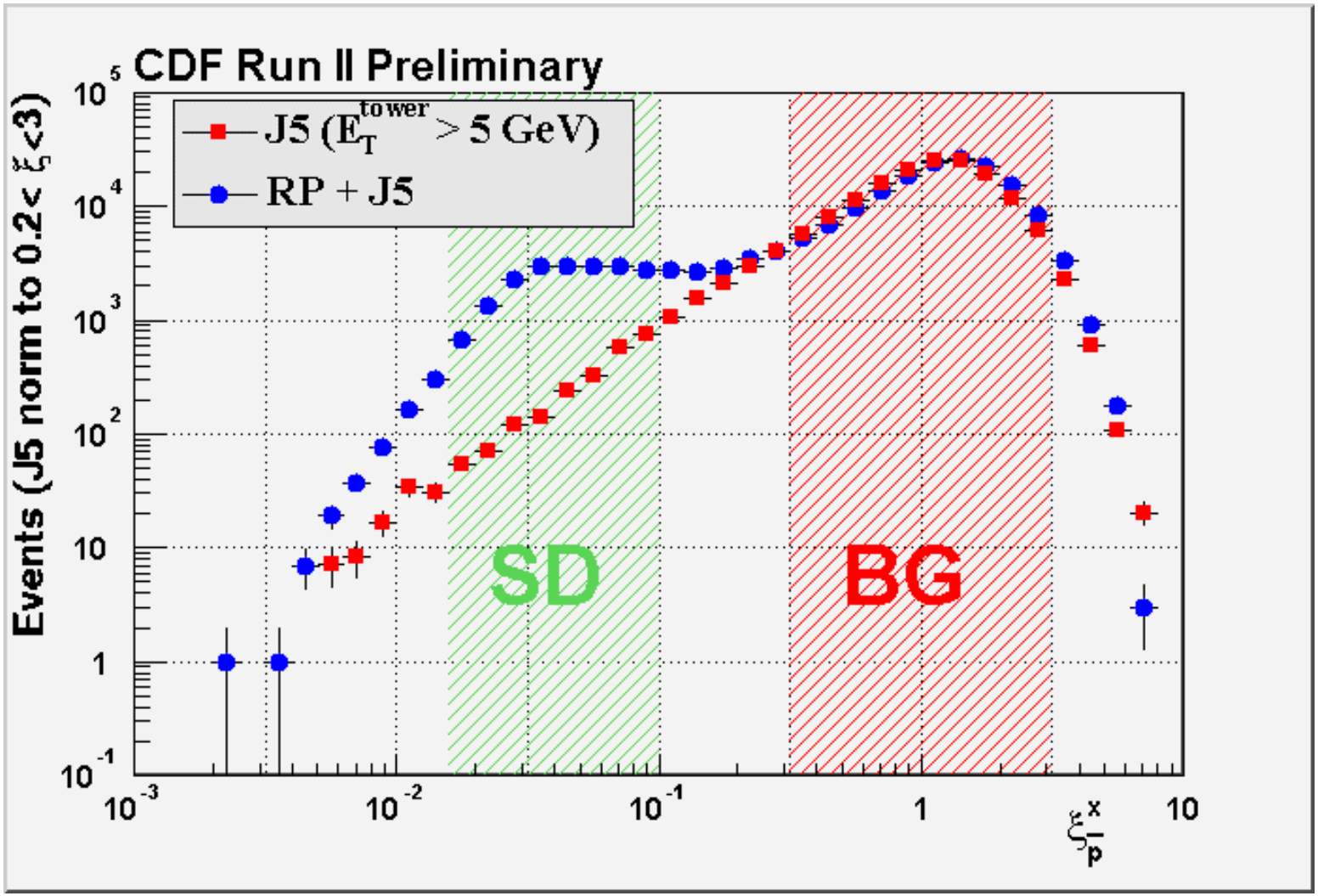
Q : What is the ratio SD/ND for E_T > 10 GeV ?

A : Slope and normalization change by ~ 1% .

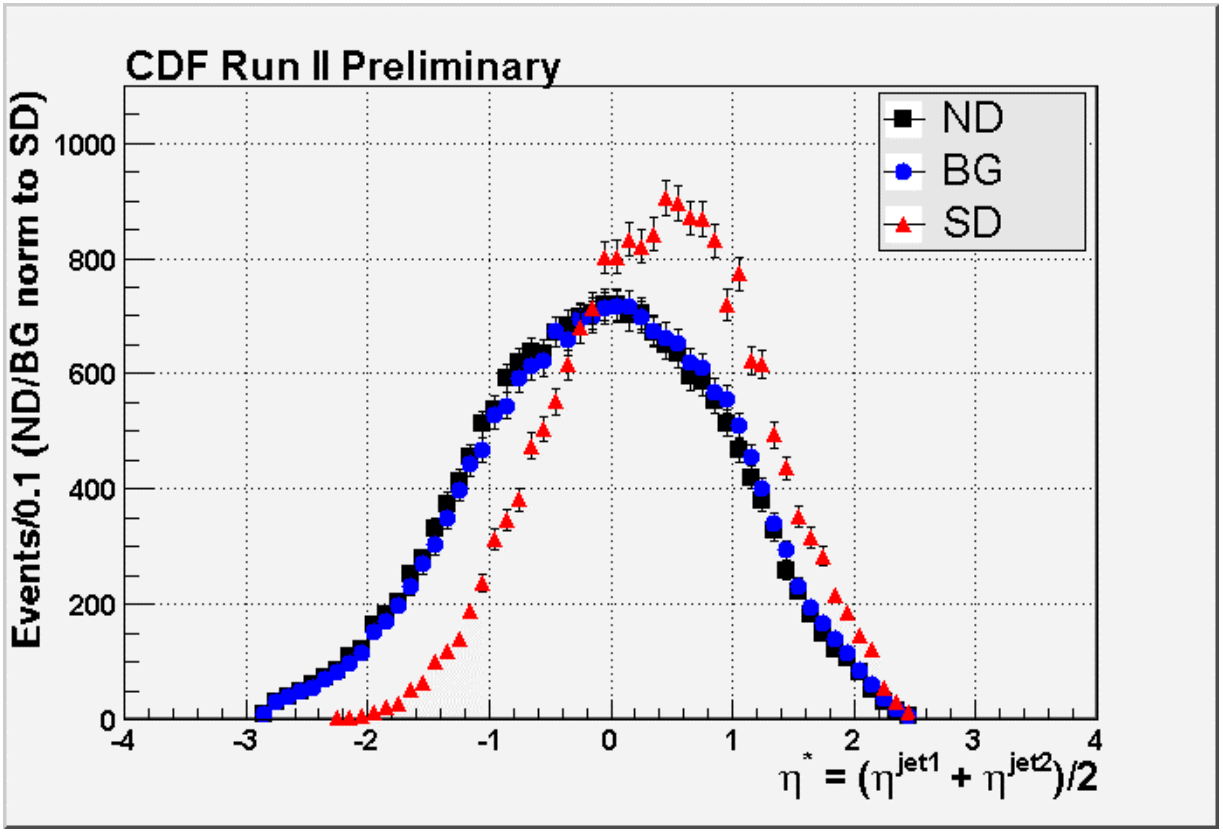
Plots For Blessing

Suggested modifications have been implemented

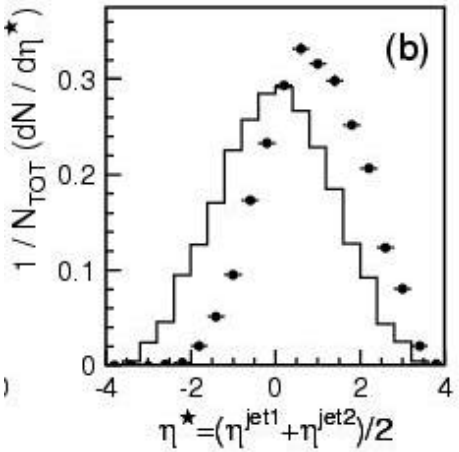
x Distribution



Rapidity

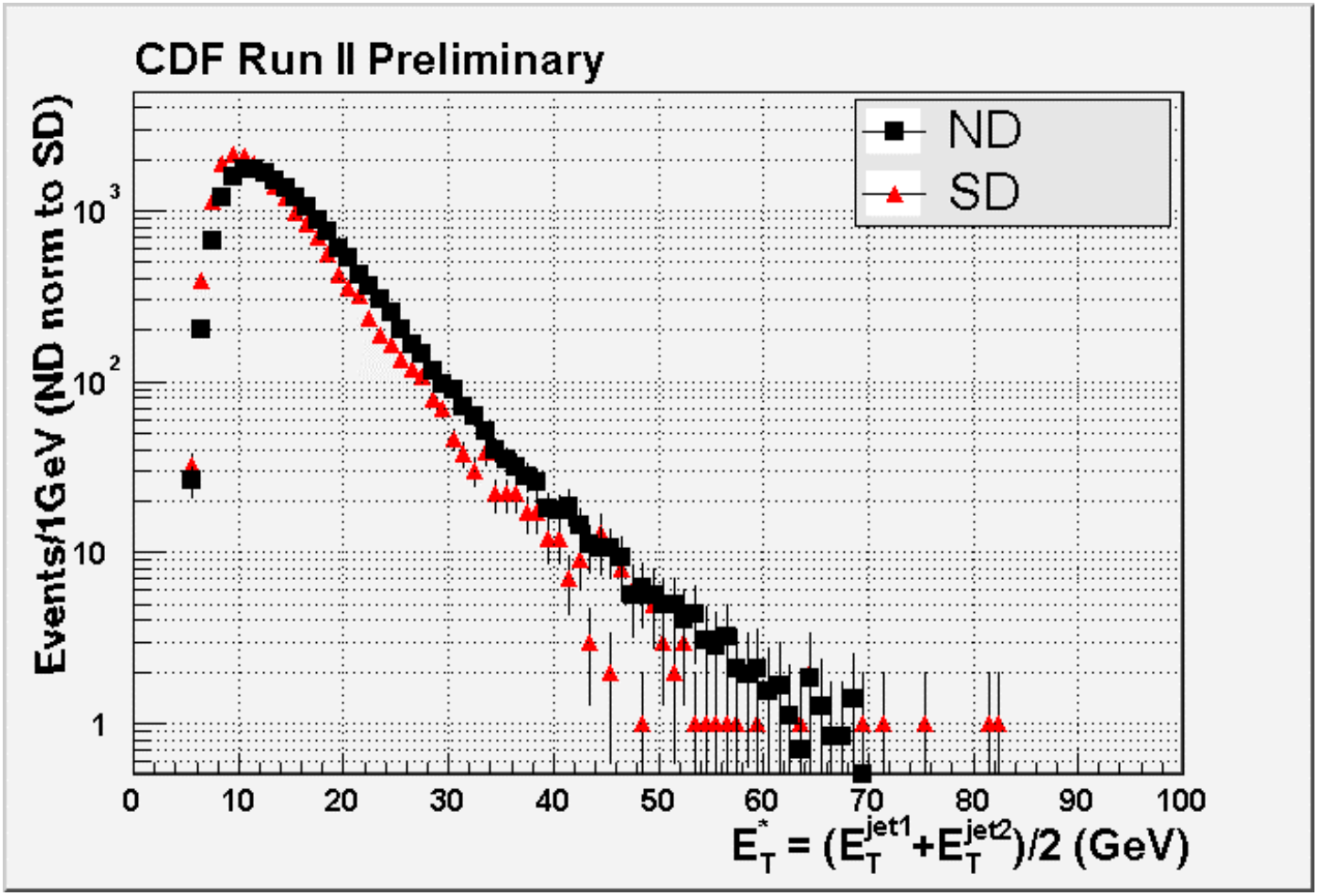


Run I PRL

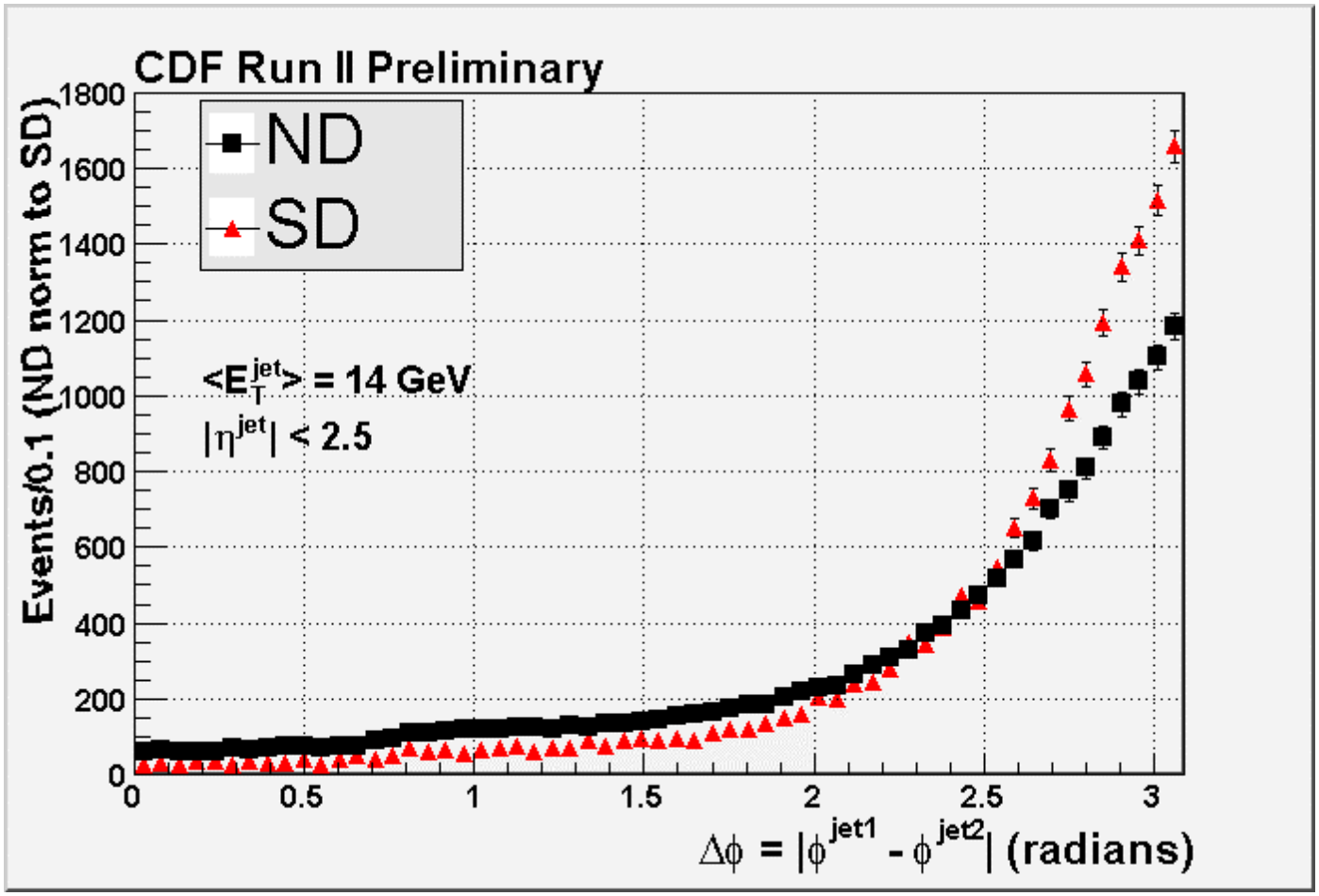


⇨ **Diffractive dijets are boosted away from the recoil antiproton**

Mean Dijet E_T

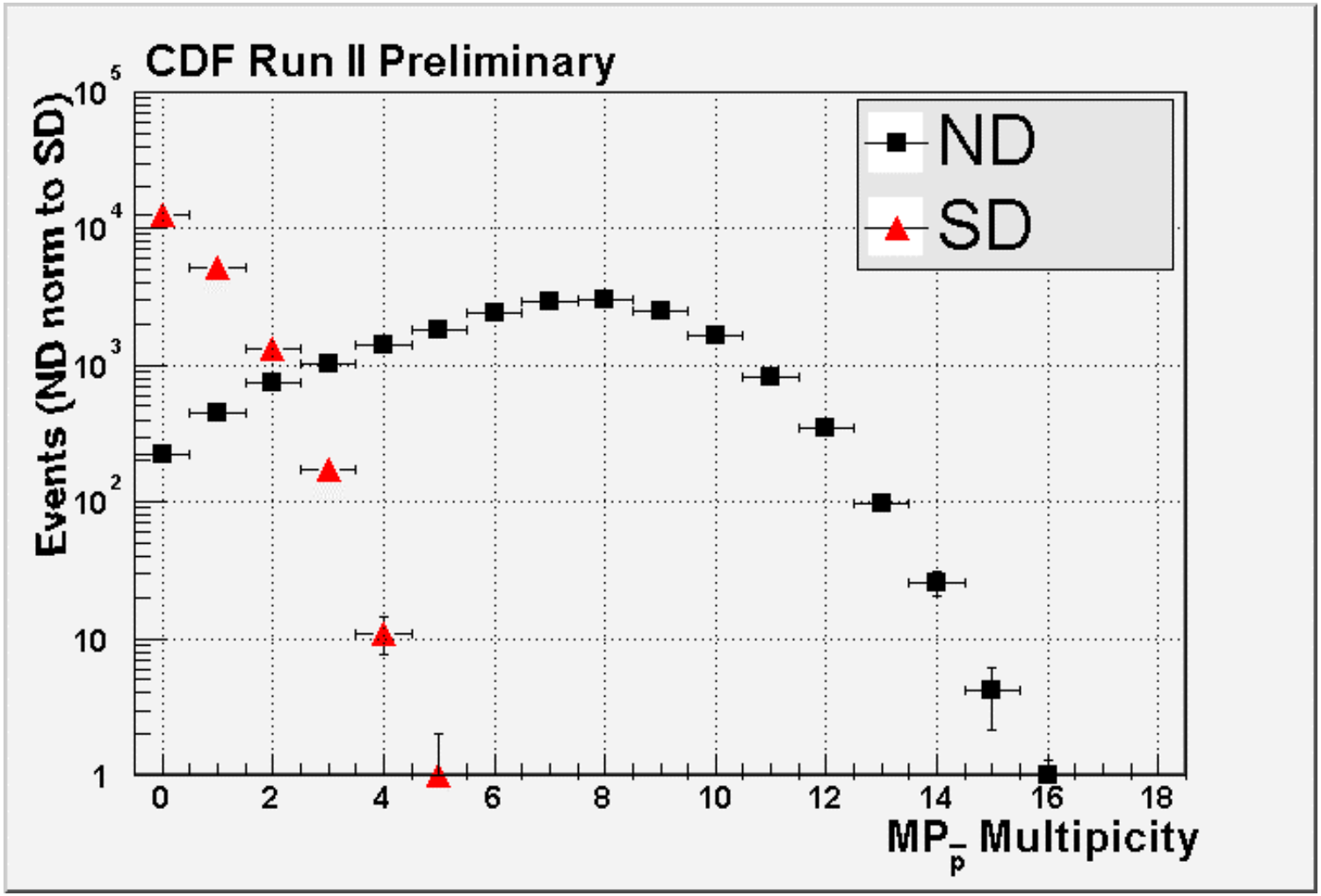


Df (jet_1-jet_2)

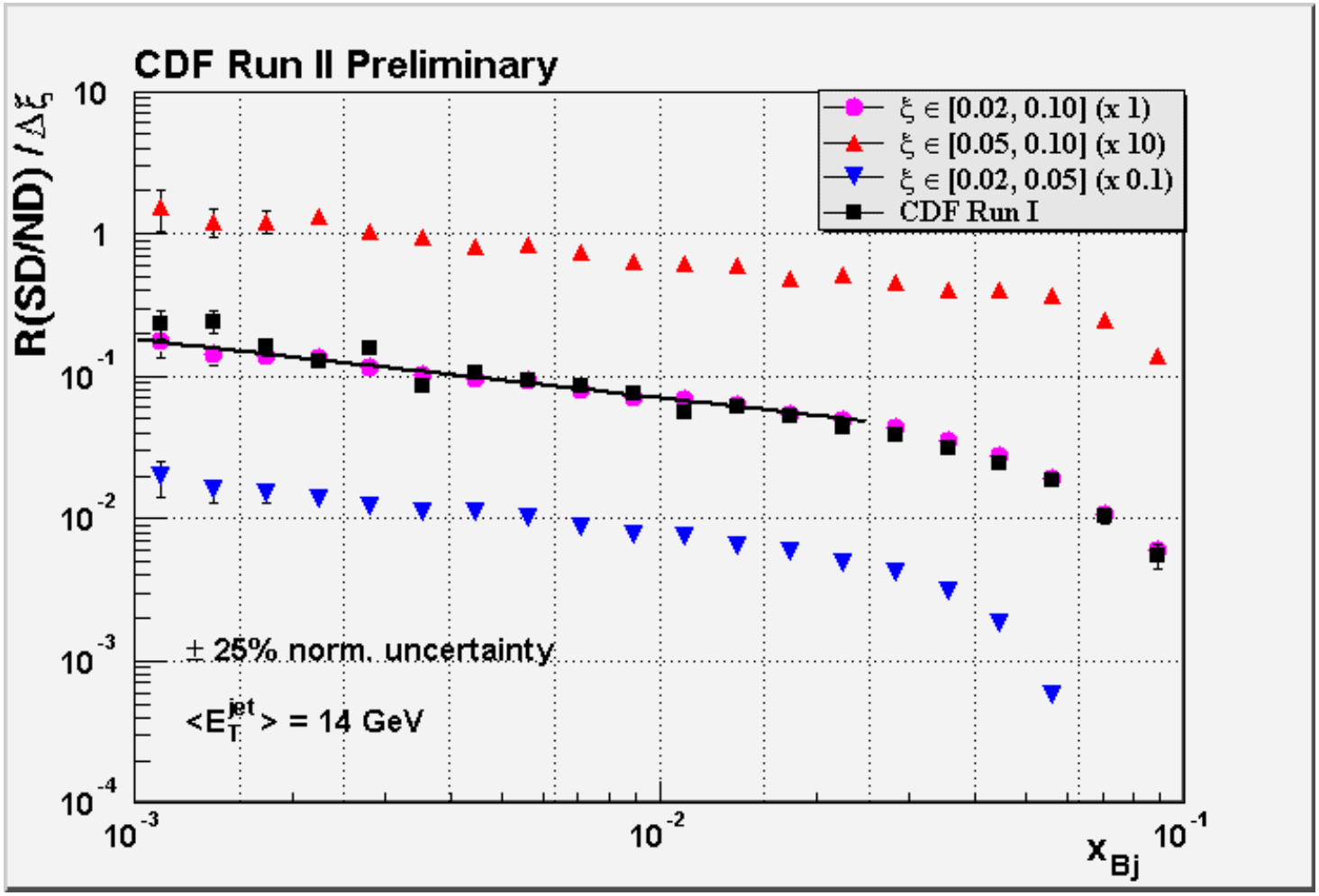


⇨ **Diffractive dijets are more back to back**

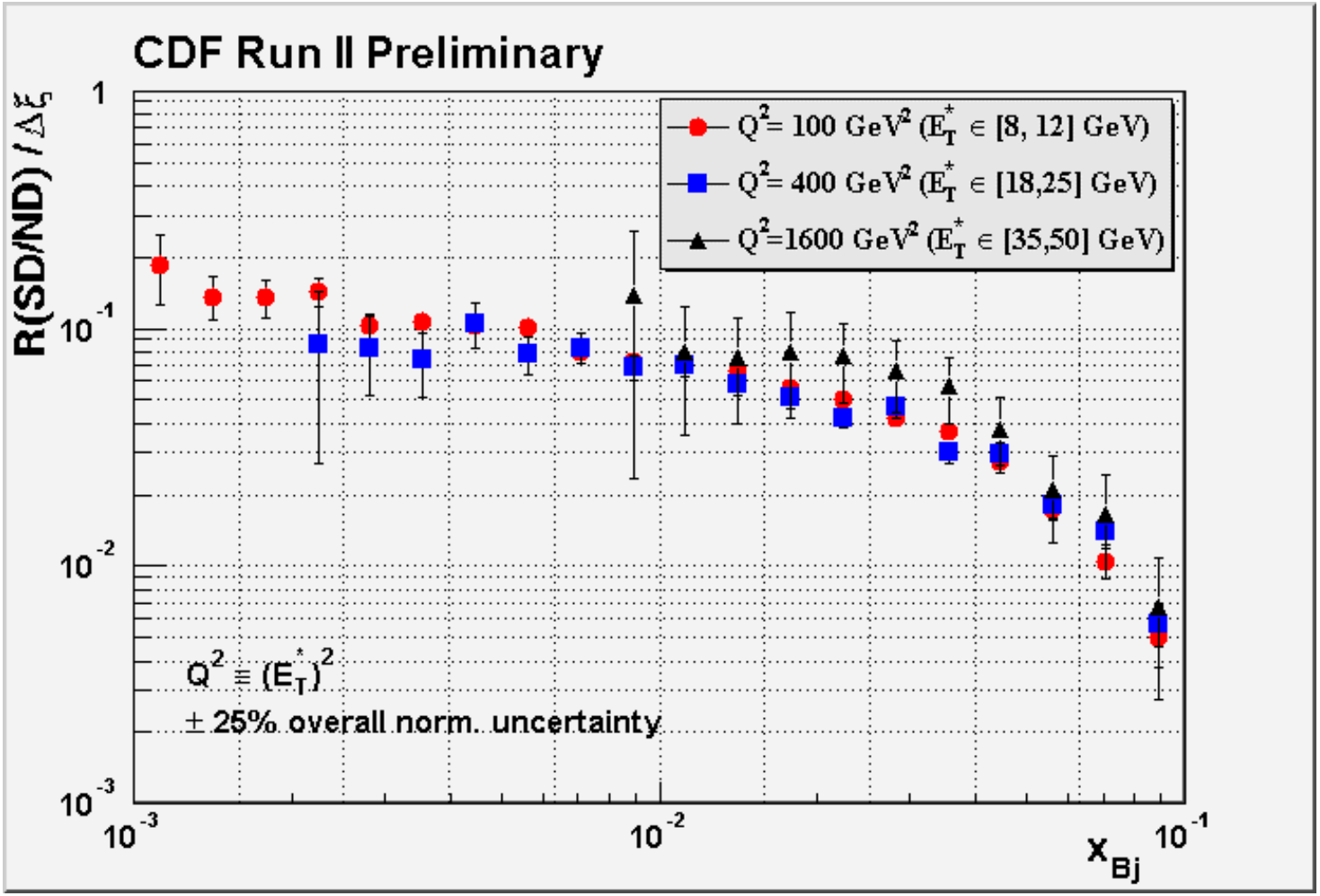
MP Multiplicity



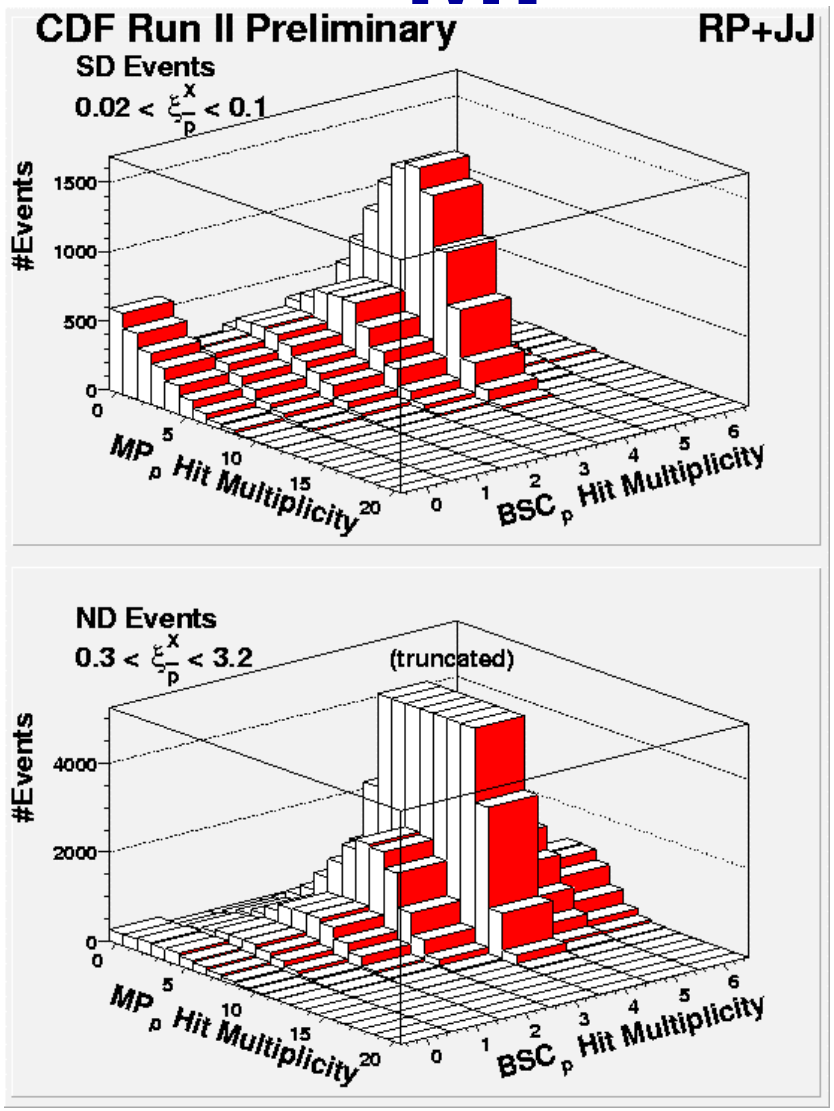
Diffractive Structure Function



Diffractive Structure Function (II)



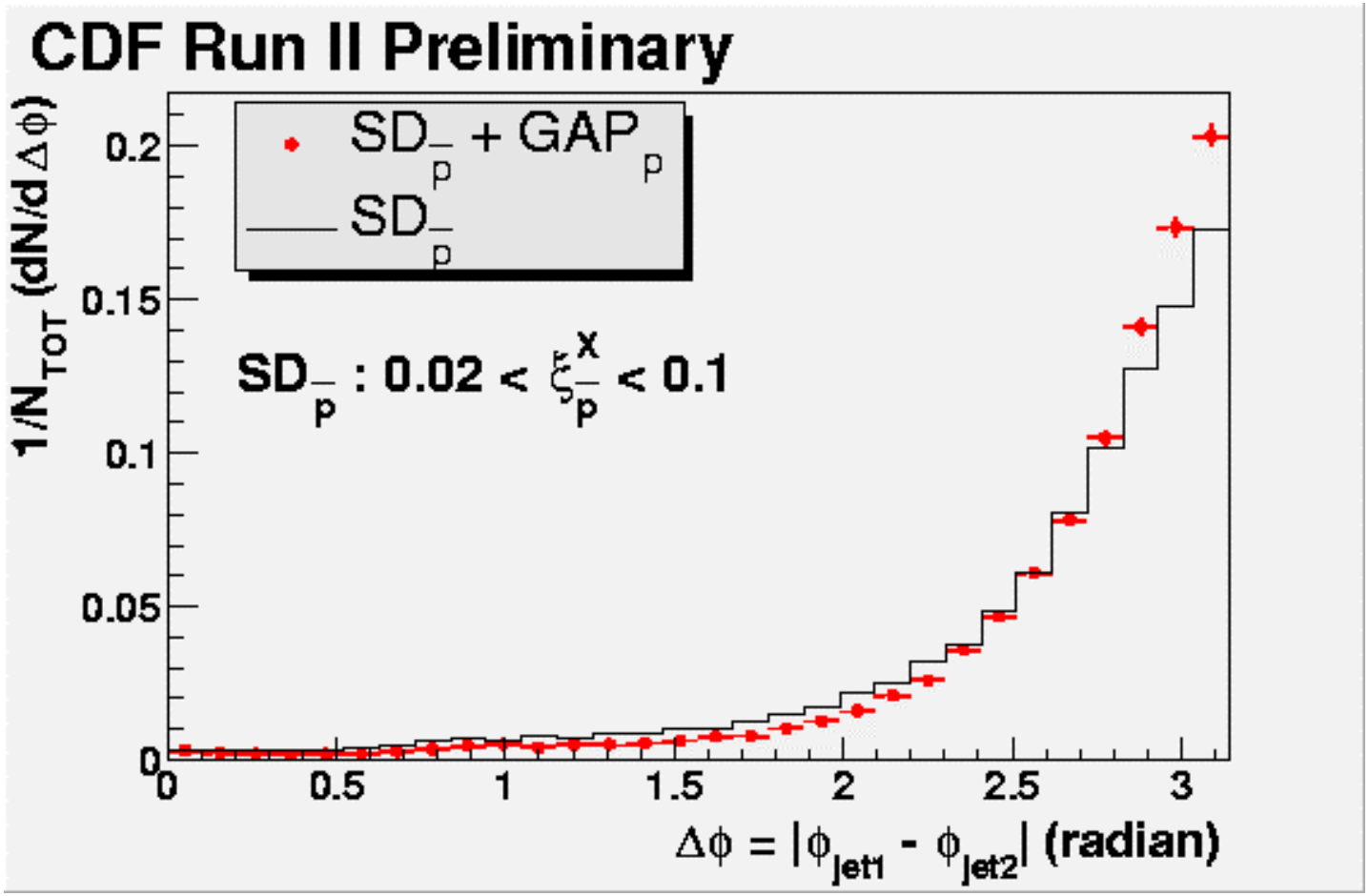
East Multiplicity: BSC vs MP



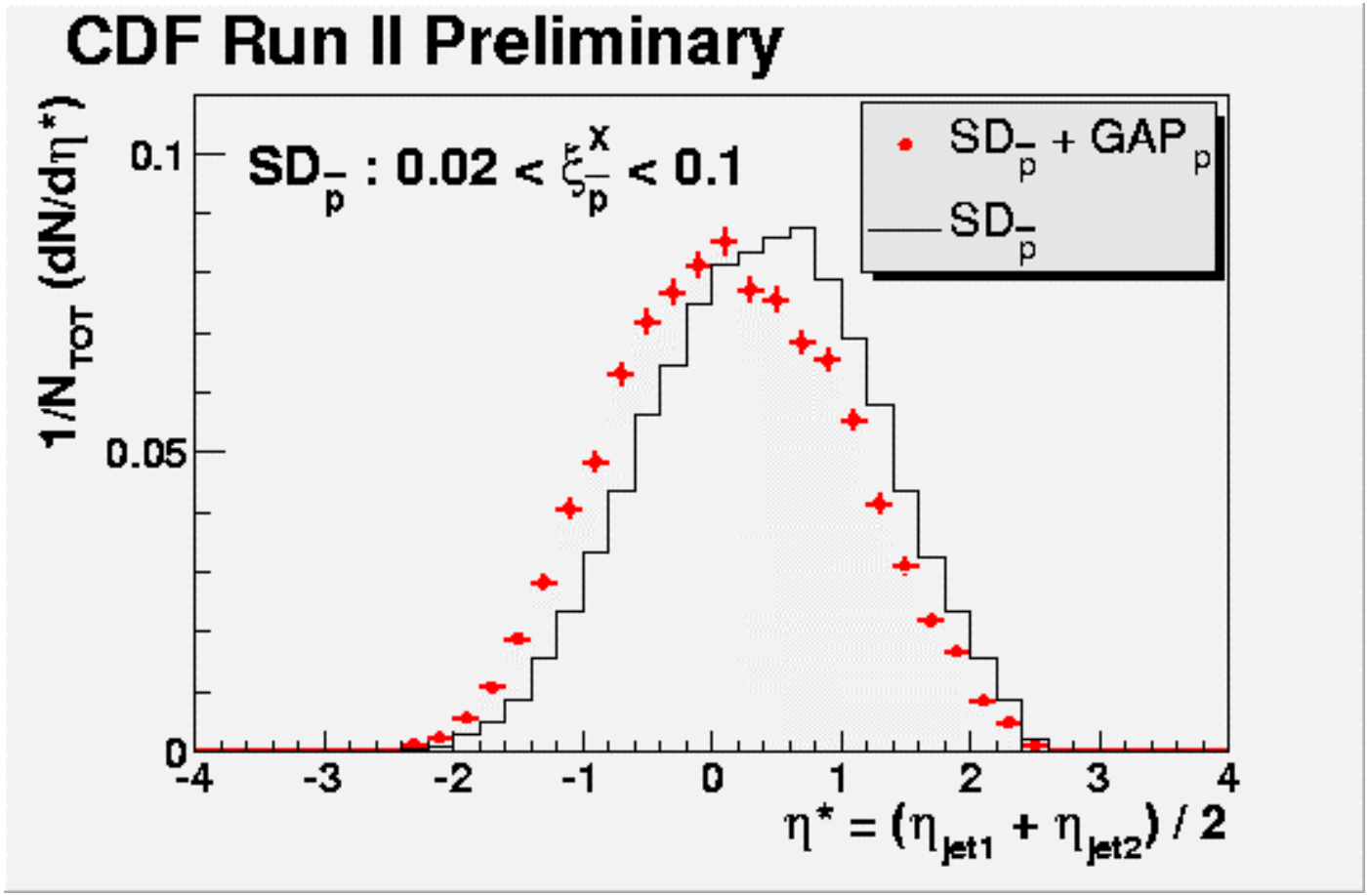
DPE Enhanced Sample

- Study a dedicated DPE trigger (RP+J5+GapE)
- ~300 k events
- $E_T(jet_{1,2})>5$ GeV
- $|\eta(jet_{1,2(,3)})|< 2.5$
- (0,0) bin ⇨ ~ 16,000 events (in Run I: 100 evts)

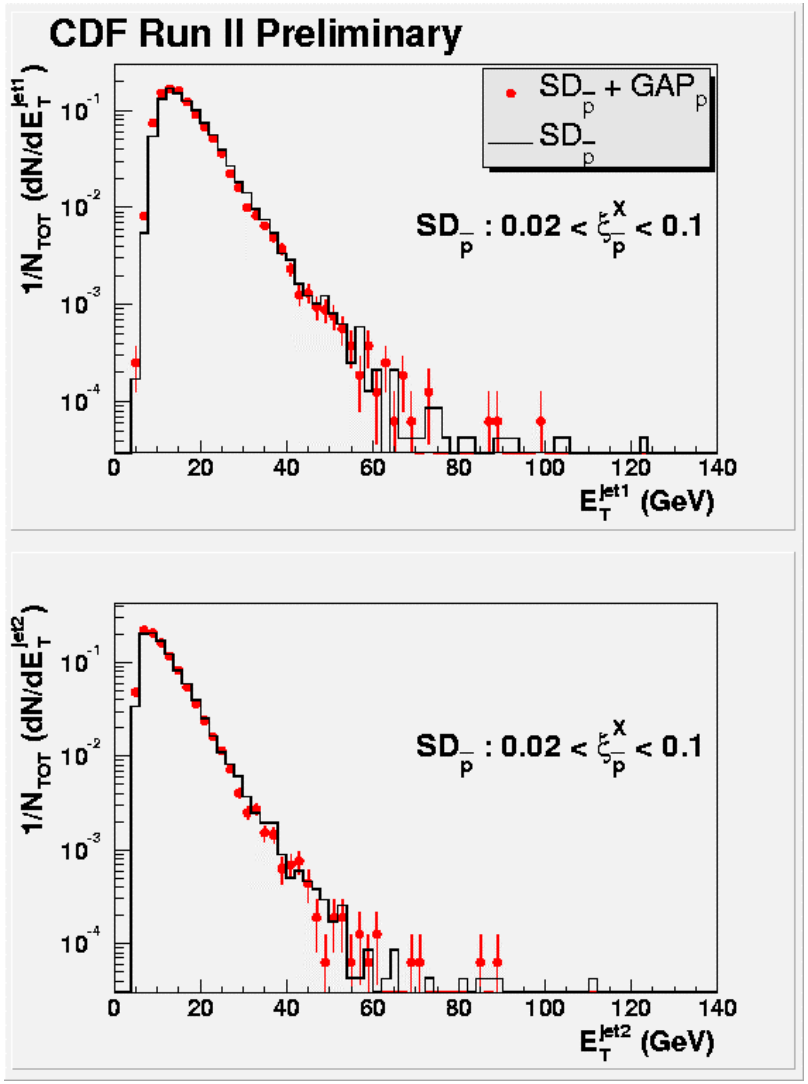
Df (jet_1-jet_2)


CDF Run II Preliminary
SD_p + GAP_p
SD_p
SD_p : 0.02 < ξ_p^x < 0.1
1/N_TOT (dN/dΔφ)
0.2
0.15
0.1
0.05
0
0
0.5
1
1.5
2
2.5
3
Δφ = |φ_jet1 - φ_jet2| (radian)

Dijet Mean Rapidity



Jet Transverse Energy



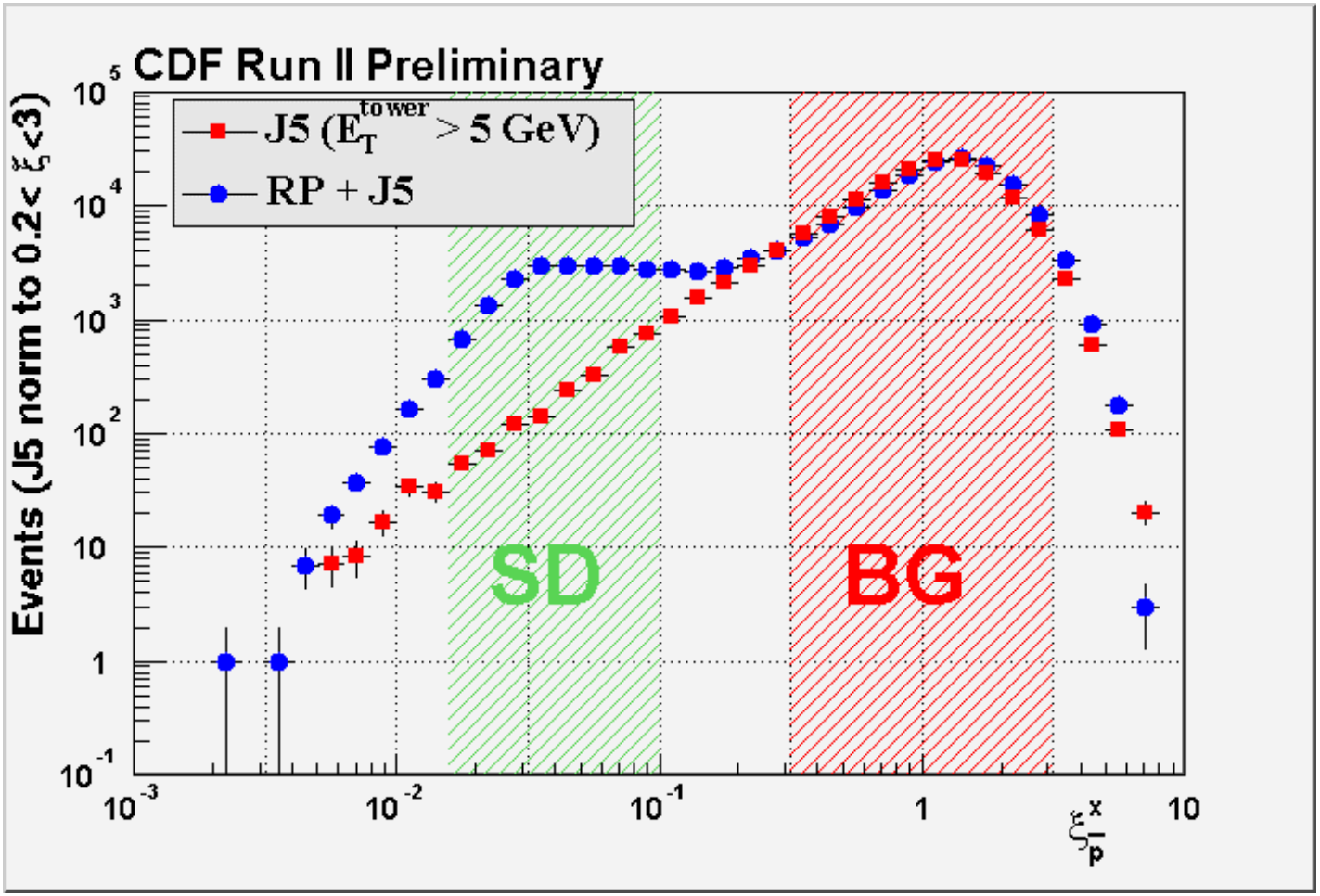
Conclusions

Relax, it is only physics.

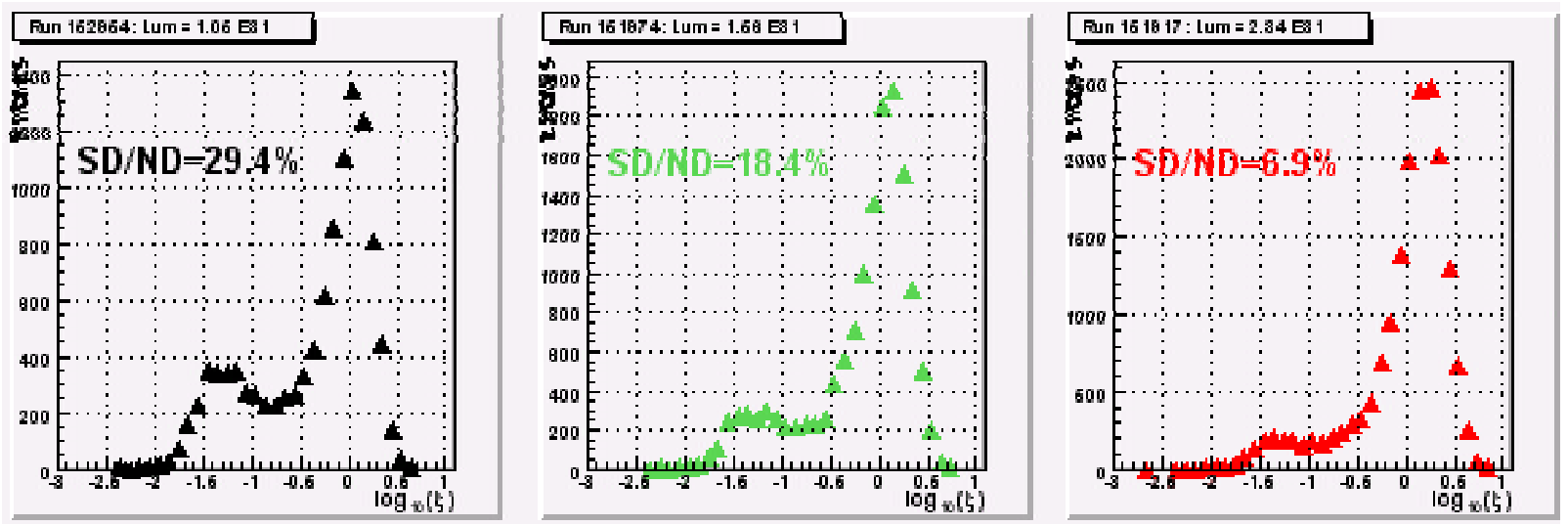
Question # 1

Q : Is the BG peak at $x \sim 1$ due to overlap events from multiple interactions?

ξ Distribution



Luminosity Dependence



Luminosity: 1.0 E31 **1.5 E31** **2.3 E31**

Overlap Rate

J5 x RP overlap

SD x MB overlap

$$R(ND/SD) = \frac{\sigma^{ND}(1 - e^{-n_{RP}}) + \sigma^{SD}(1 - e^{-n})}{\sigma^{SD} e^{-n}}$$

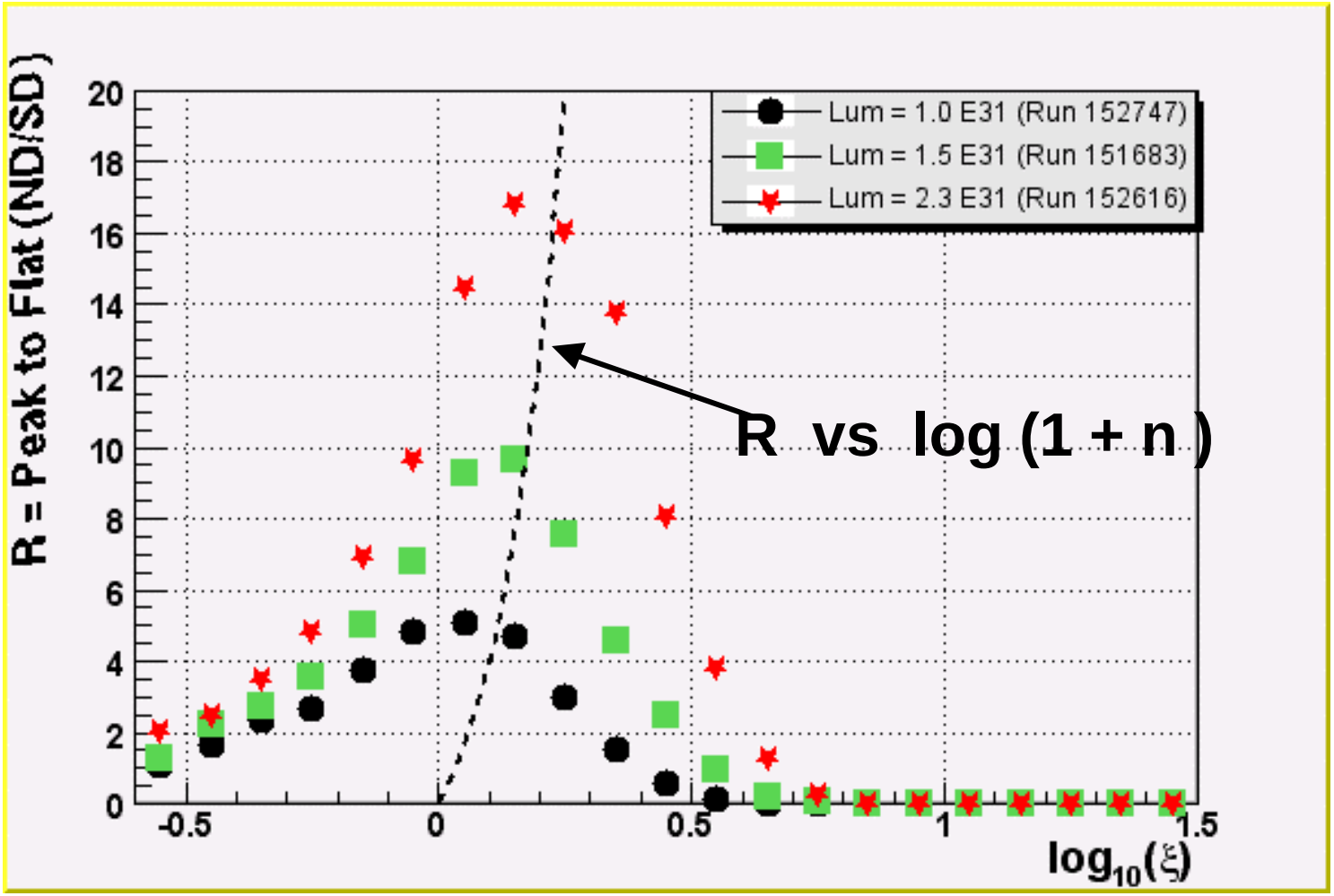
SD surviving MB overlap

$n_{RP} = (1\ mb/50\ mb) \times n$, $n = 0.3 \times L[1 \times E31]$

$\sigma^{ND} / \sigma^{SD} \sim 600$

$\Rightarrow$ $R(ND/SD) = 12\ n\ e^{n}$

Multiple Interactions Shift ND Peak



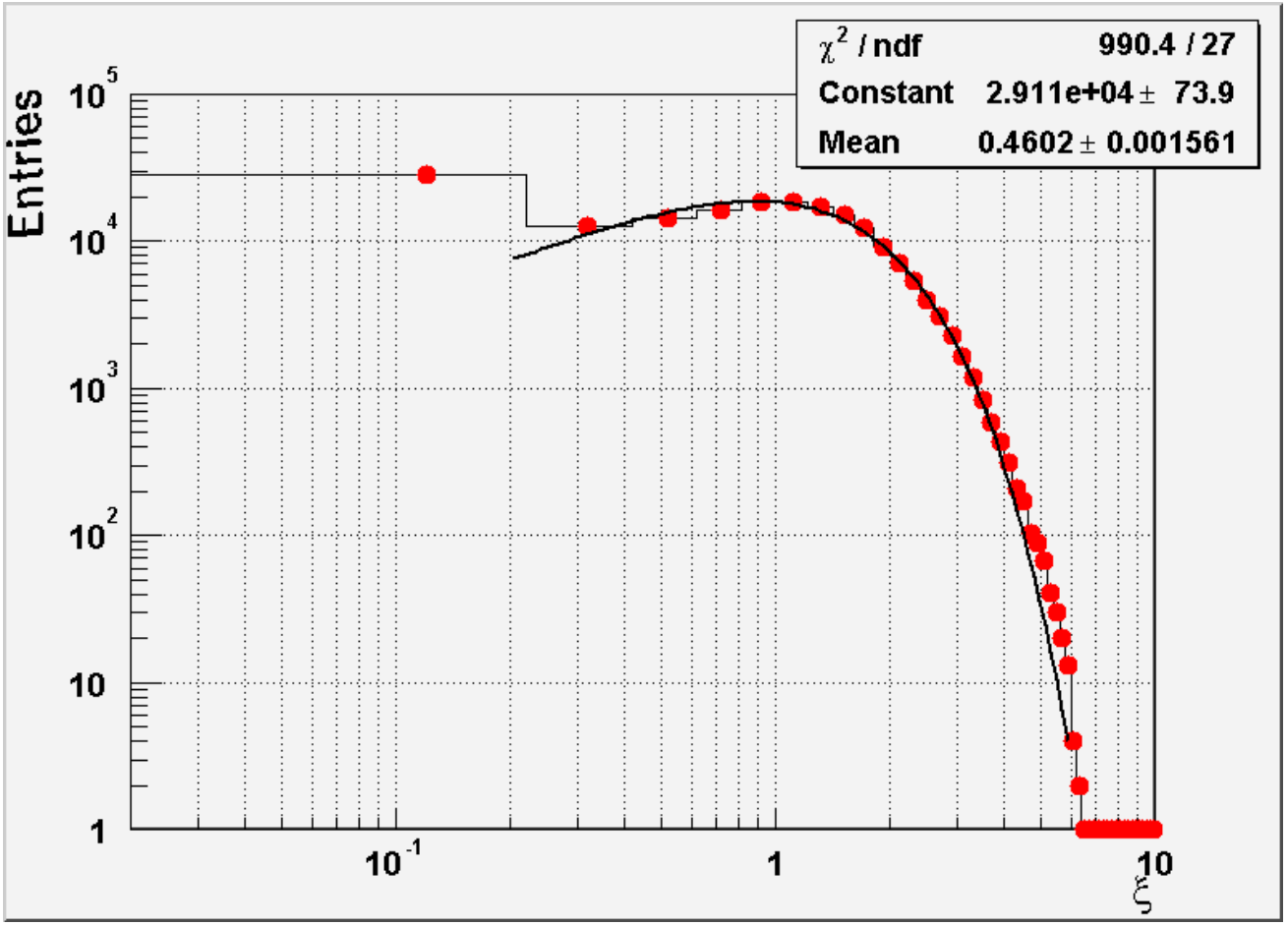
Run I vs Run II

	Run I	Run II
L um / bunch	0.16E30 / 6	20.0E30 / 36
$\sigma^{ND} / \sigma^{SD}$	300 (lower jet E_T)	600

R (Run I/Run II) = 1/60

R (Run II) = 10 ⇨ R (Run I) = 0.15

Multiple Interactions



Answer to Q# 1

Q : Is the BG peak at $x \sim 1$ due to overlap events from multiple interactions?

A : Yes.

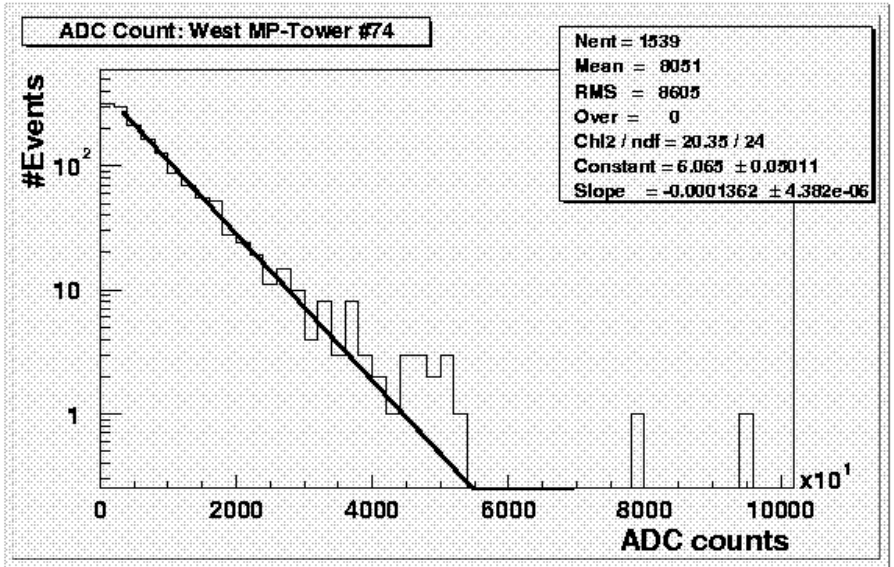
1. **Ratio is consistent with Run I numbers and Run II expectations.**
2. **Peak at $x \sim 1$ shifts according to luminosity, as expected.**

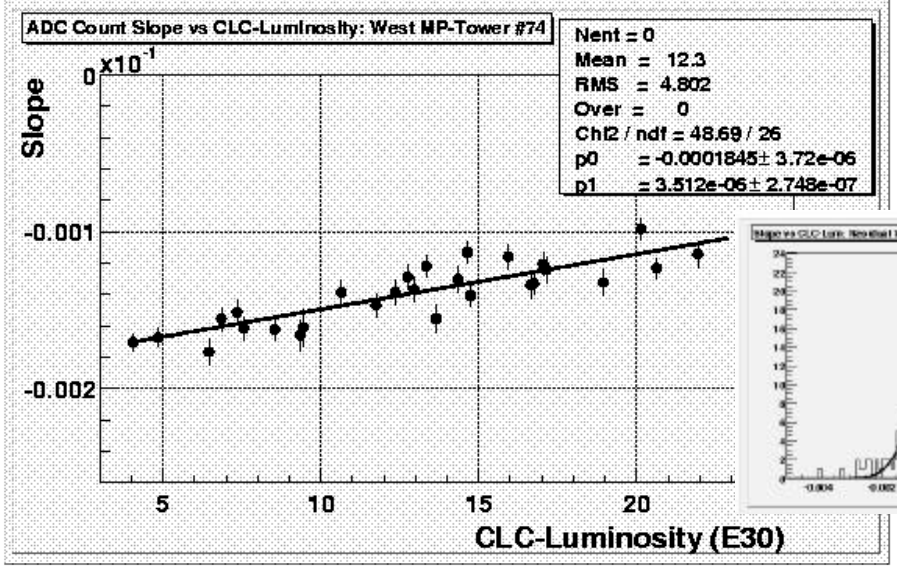
Question #2

Q : What is the effect of the MP energy scale calibration ?

MP Calibration

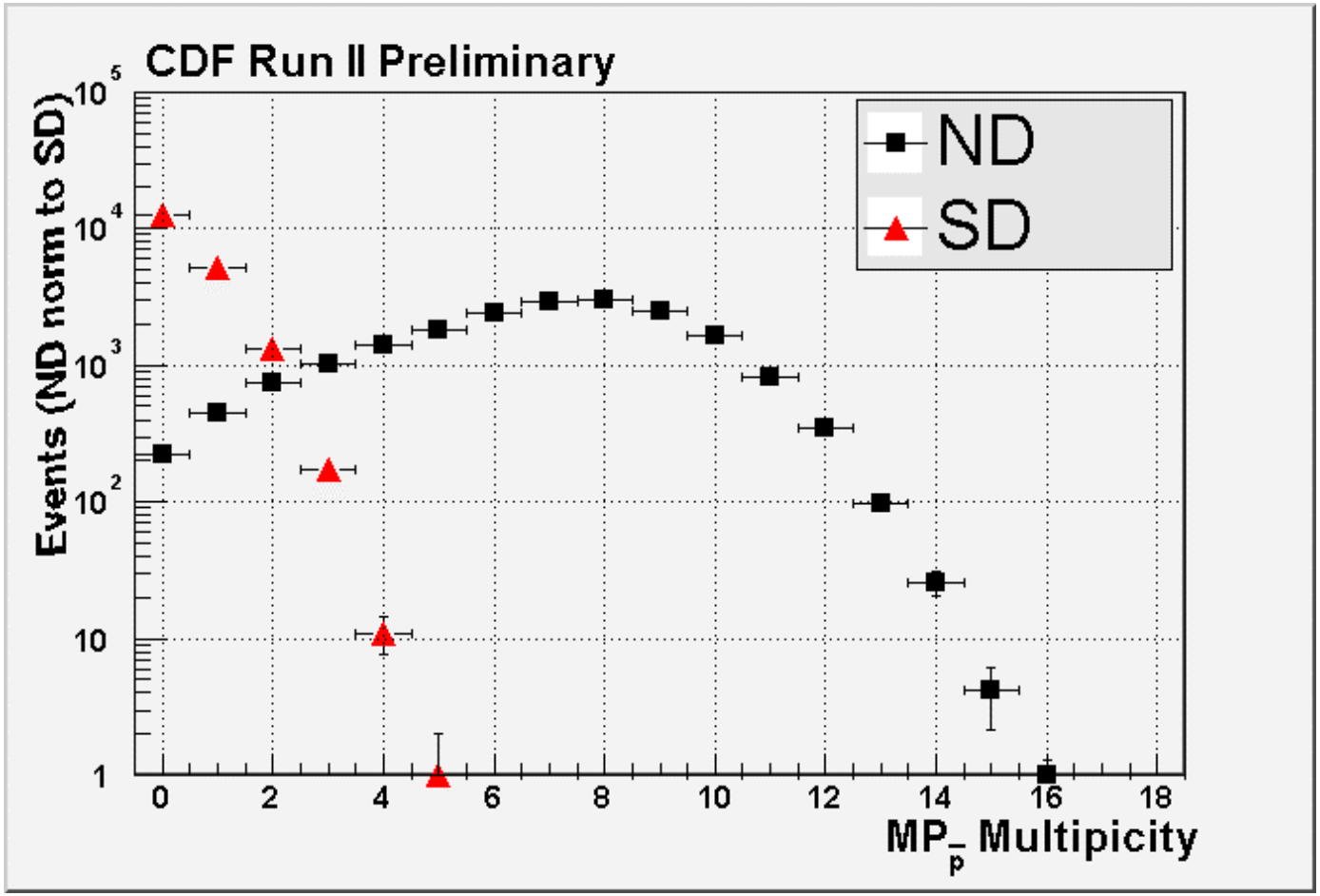
- Use slope from ADC distribution
- Tower-to-tower relative calibration with data/MC
- Energy scale from MC
- MC/MBR



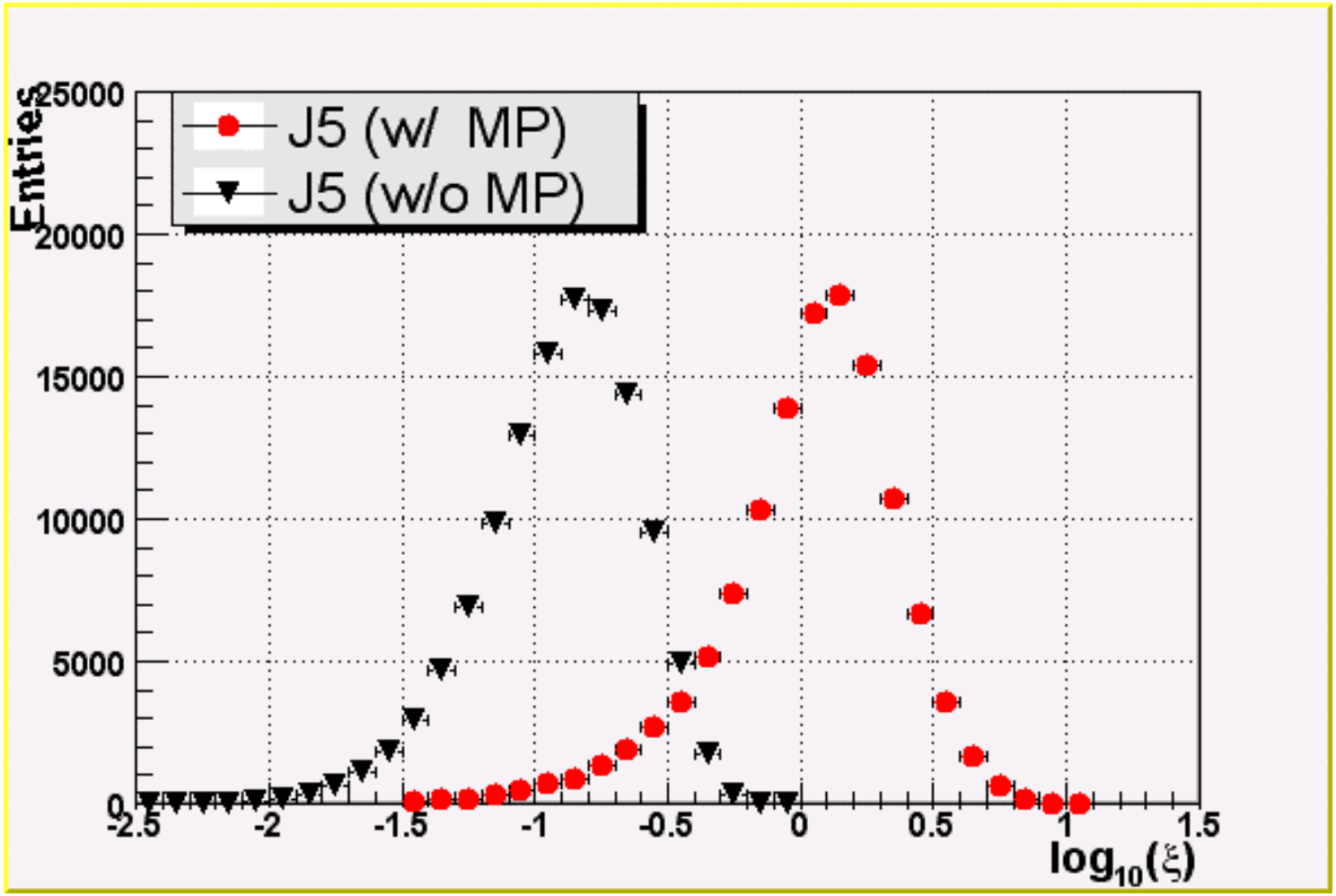


- ✓ Pile-up at high luminosity
- ✓ (Slope-Fit)/Fit ~7% for each h ring
- ✓ Time dependence (LED)

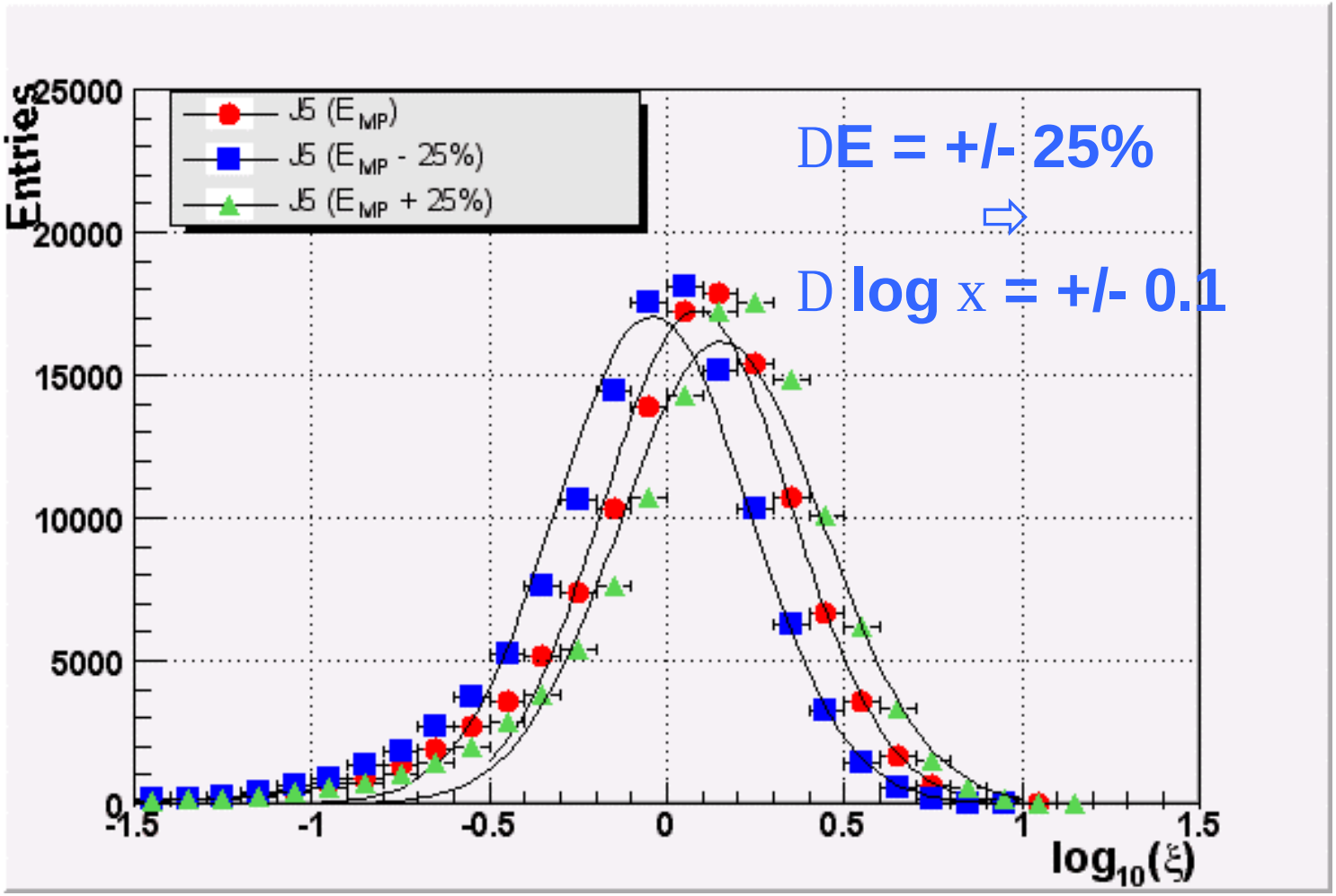
MP Multiplicity



MP Contribution to x_{ND}



Effect of MP Energy Scale



Answer to Q#2

Q : What is the effect of the MP energy scale calibration ?

A : An energy scale variation of +/- 25% yields

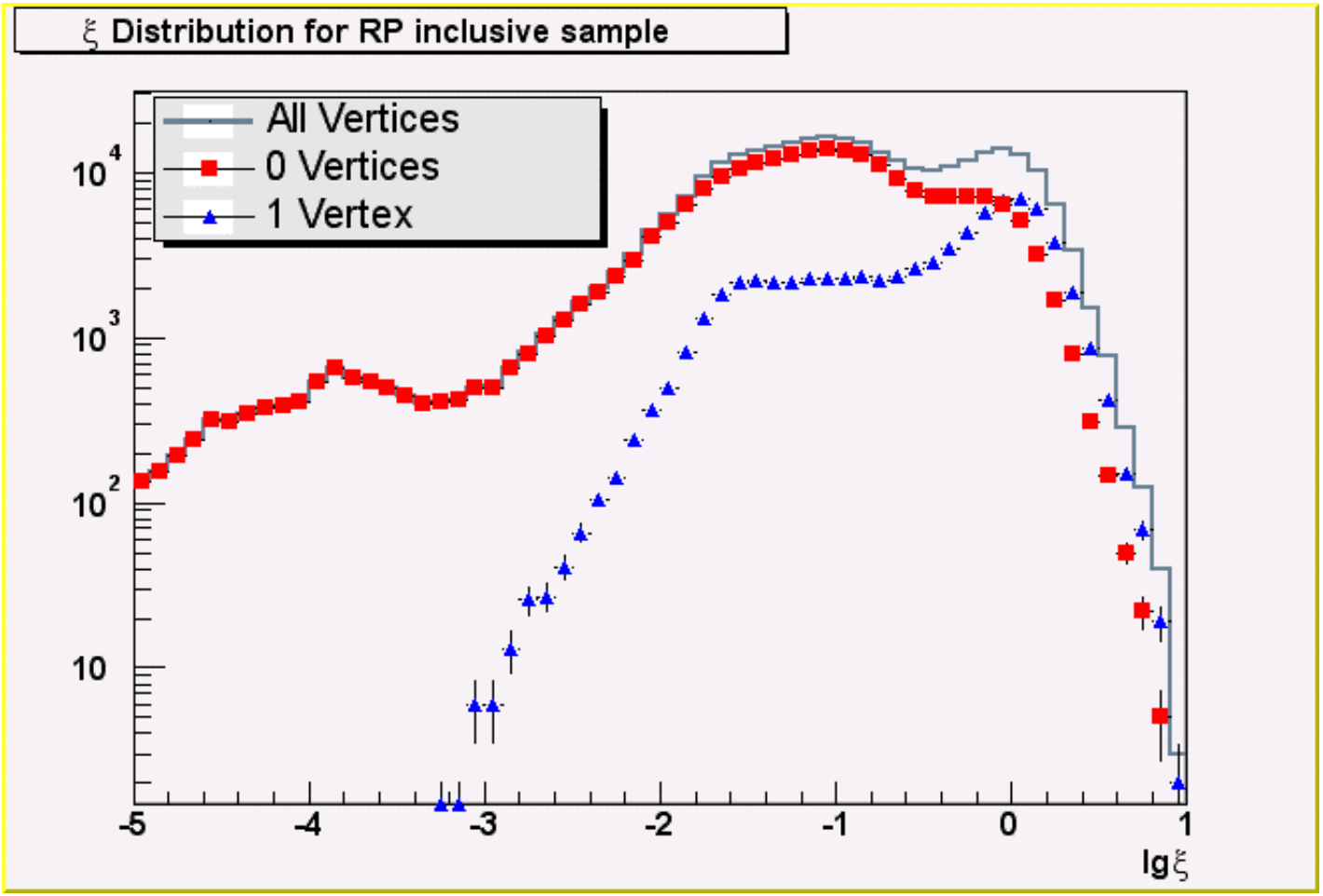
$\Delta \log x$ **= +/- 0.1.**

1. $\Delta \log x$**=0.1 is the bin width of our** x **distribution .**
2. **Peak position in data is centered where expected, indicating the energy scale uncertainty is < 25% .**

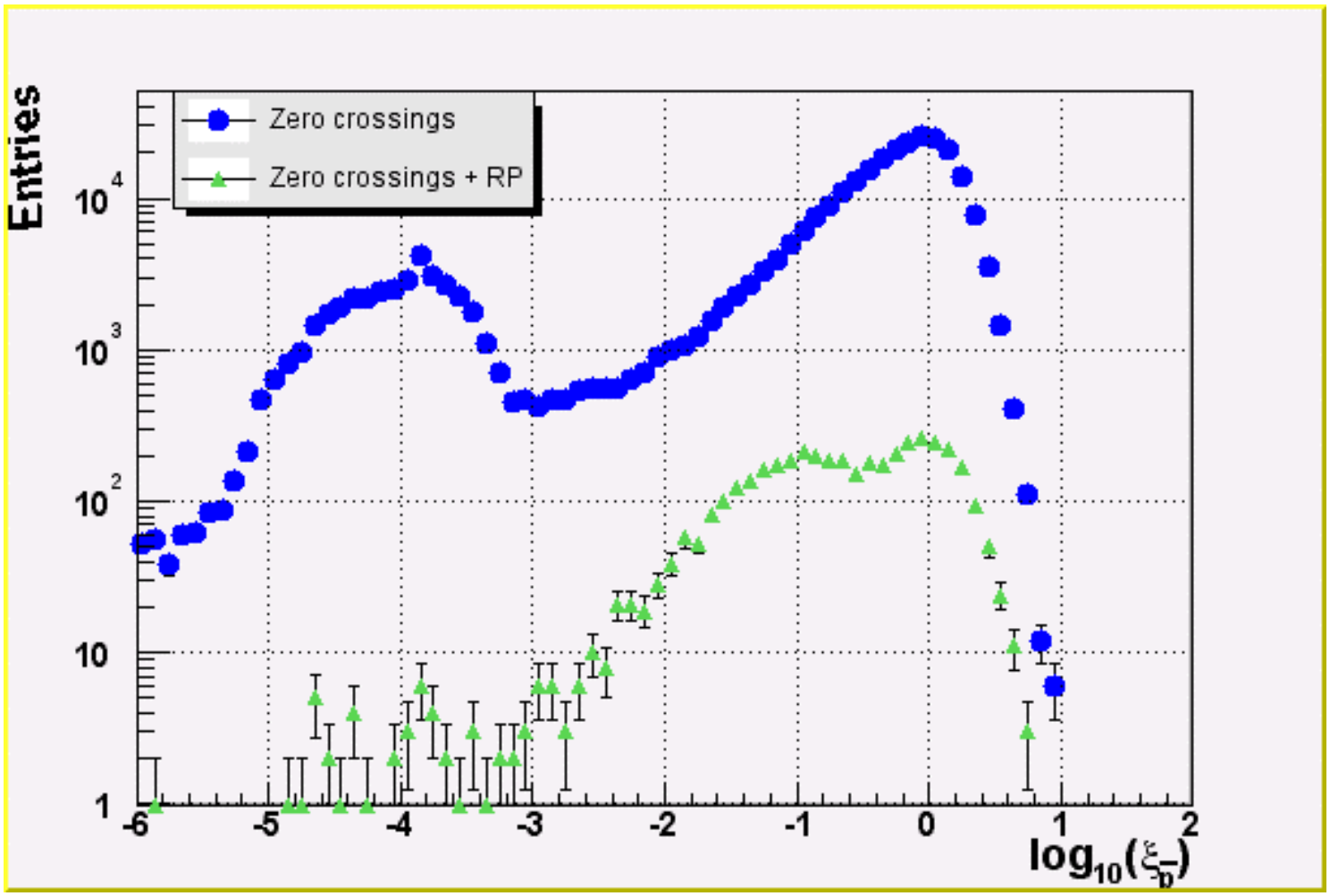
Question #3

Q : What is the background in the RP inclusive rate ?

RP Inclusive Data



Zero Crossings



Answer to Q#3

Q : What is the background in the RP inclusive rate ?

A : It is 1-2% of all RP triggers, concentrated at log x < - 3